Space Weather Technical Forecast

Issued on Wednesday, 09 March 2022 at 00:58 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1 Minor Geomagnetic Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Low over the period, with activity confined to isolated low C-class, these most likely from AR2965 which has rotated into view over the past 24 hours. AR2965 is likely to be complex, but currently is too close to the northeast limb for clear analysis. There are five other numbered region on the visible disc, of which AR2960 remains the most significant as a Ehi/beta group, although the region has reduced slightly in size with the loss of some intermediate spots. AR2957, AR2962 and AR2963 all have shown slight decaying trends, with spot numbers decreasing. Meanwhile AR2964 has lost some intermediate spots, while the penumbra on the trailing spots has increased slightly, and is now classified as Dso.
A large filament eruption occurred from the northwest quadrant around 08/0400UTC, from near the plage containing now-faded Ex-2958. The associated CME is not expected to be Earth-directed.

Solar Wind / Geomagnetic Activity: The solar wind was characteristic of a waning connection to a negative polarity high speed stream, probably that from CH61/- and 62/-. The phi angle was accordingly mostly negative (towards the Sun). The solar wind speed, as measured by DSCOVR at L1, started around 500 km/s, and peaked at 517 km/s at 08/0025 UTC, but then gradually decreased to end the day near 400 km/s. The density was average but then fell to below average. The IMF weak at or below 4nT, while the north-south component was either neutral or weakly negative. The corresponding geomagnetic activity was initially Unsettled (Kp 3) but quickly decreased to become Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) measured at GOES 16 was at Background levels.
The high energy electron flux (greater than 2 MeV) was mainly High, with a peak value of 4769 pfu at 08/1800UTC. The corresponding 24-hour integrated electron fluence remained above the Active level, but with a gradually decreasing trend. The 09/0000 UTC observation was 2.15e8 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low, with further isolated C-class flares and a slight chance of M-Class activity.

Solar Wind / Geomagnetic Activity: After starting with residual effects from a HSS, from CH61/62, two low confidence CMEs are in the forecast. The first may arrive late today (9th) and the other late tomorrow (10th). Geomagnetic activity is expected to be initially Quiet (Kp 0-2), then probably increasing Unsettled to Active (Kp 3-4) later today and perhaps again late tomorrow, with a chance of G1/Minor Geomagnetic Storm (Kp 5) intervals. Then activity is expected to return to Quiet levels (Kp 1-2) again for day 4 (12th).

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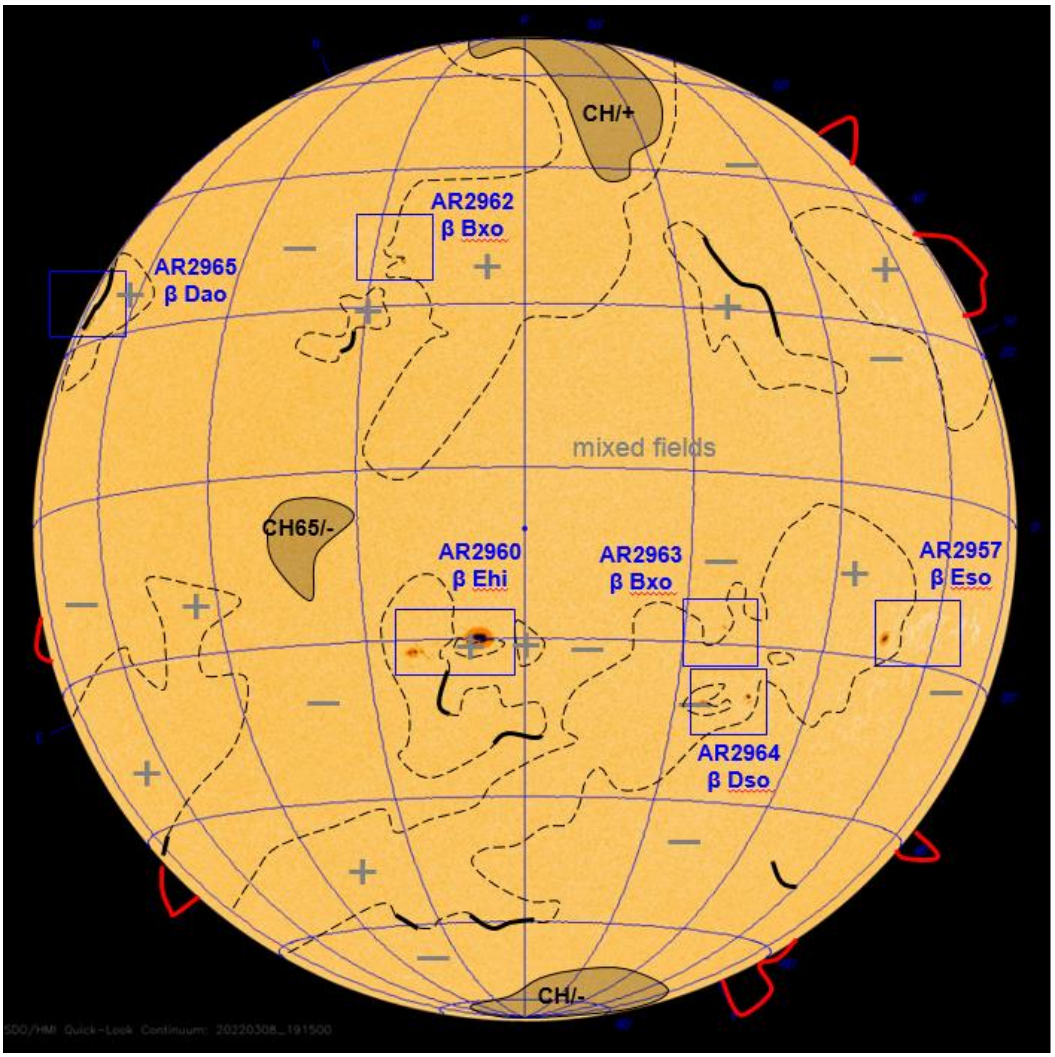
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels, albeit with a very slight and increasing daily risk of S1. The high energy electron flux is expected to persist at High levels but with a chance of drop-out from any of the CME arrivals. The associated 24-hour fluence is expected to remain Active through much of the period, but with increased uncertainty due to the potential CMEs.

Figure 1. Solar Analysis Valid 08/1915 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

After starting with the solar wind at or close to background levels, with Earth having left the previous HSS from CH61/62, two low confidence CMEs are in the forecast. The first may arrive late today (9th) and the other late tomorrow (10th), with the CME's emitted on the 6th and 7th respectively.
Geomagnetic activity is expected to be initially Quiet (Kp 0-2), then probably increasing Unsettled to Active (Kp 3-4) later today and perhaps again late tomorrow, with a chance of G1/Minor Geomagnetic Storm (Kp 5) intervals. Then activity is expected to return to Quiet levels (Kp 1-2) again for day 4 (12th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
06/0650	Partial	Unknown	N04E15	224km/s	After 09/2100UTC	Very low confidence, with uncertain source.
07/0920	Partial	Ex-2958	N10W24	417km/s	10/2100UTC	Good confidence, but only glancing impact likely.

Figure 2: Latest MOSWOC Enlil run and ensemble, showing the two potential Earth-bound CMEs merging and arriving on the 10th. Confidence remains low.

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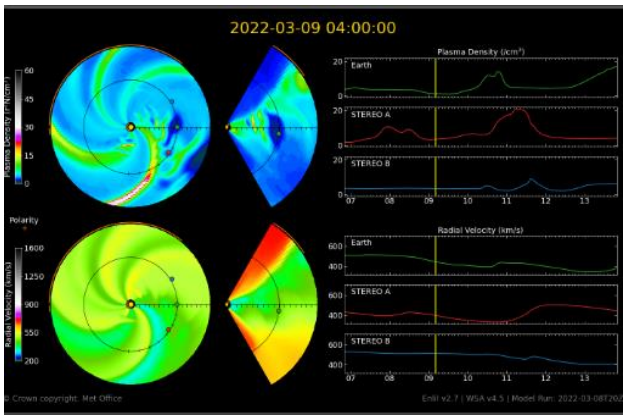
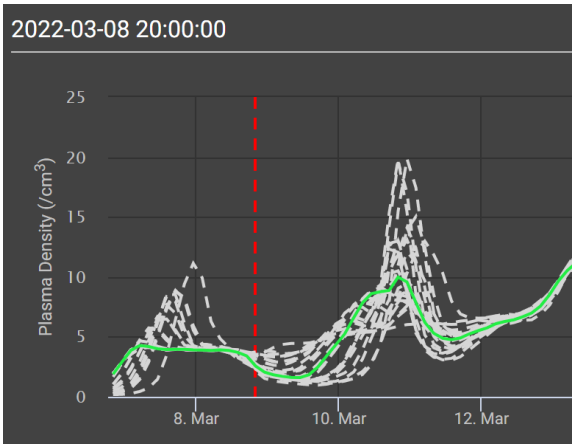
Met Office Space Weather Technical Forecast





Radio Blackouts - X-Ray Flares:

Both of the sunspot regions that are contributing most significantly to the daily chances of X-ray flares are expected to remain on the Earth-facing side in the period, these being AR2960, an Ehi/Beta, and also the newly emerged AR2965 in the northeast quadrant, currently classified as a Dao/beta. However, despite these regions solar activity has been low over the past 24 hours. Far side soundings and EUV imagery from STEREO suggest there may be some northern hemisphere returning regions at the end of the forecast period, although the contribution of these is not yet considered.

Activity is expected to remain Low with C-Class flares expected and a slight chance of M-flares, these most likely from AR2965.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	25	25	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES 16 is currently at Background levels. The raw probabilities for S1 or above suggest a very low but 'measurable' risk at present, which should increase through the four days - mainly the result of AR2960's Ehi/Beta classification and imminent arrival into the western hemisphere.

Radiation Storms	Level (cm^{-2}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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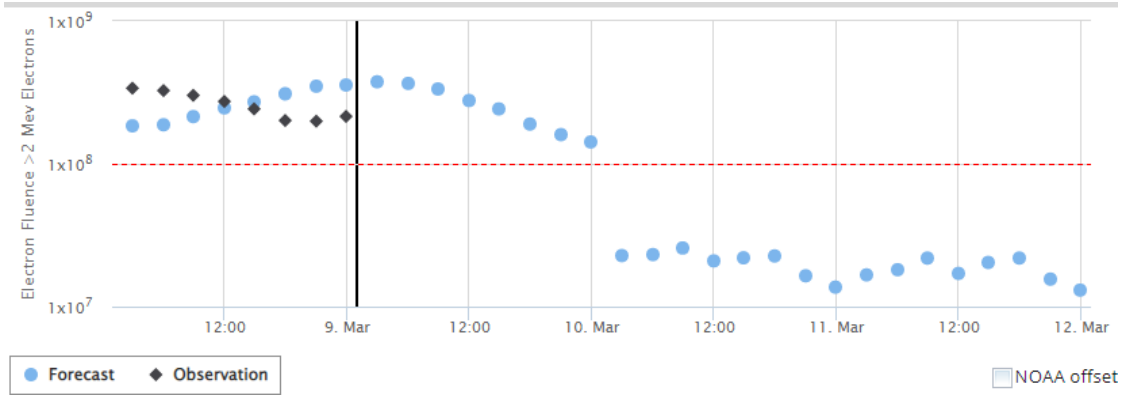
Probability (Exceedance)	$sr^{-1} s^{-1}$)	(Yes/No)	(%)	(%)	(%)	(%)
Active	≥ S1	No	2	2	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy electron flux is expected to persist at High levels but with a chance of drop-out from any of the CME arrivals. The associated 24-hour fluence (greater than 1e8 integrated pfu) is expected to remain Active through much of the period, but with increased uncertainty due to the potential CMEs.
As the Met Office REFM is unaware of potential CME's it is not considered to be a useful source of information, although it does serve to highlight the expected waning trend should all the forecast CMEs miss.

GEO Electron Environment	Level ($cm^{-2} sr^{-1} day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	Yes	100	80	60	40
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Met Office REFM model.



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